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NITROGEN GEOCHEMISTRY OF A CRETACEOUS-TERTIARY BOUNDARY SITE IN NEW ZEALAND

Iain Gilmour* and Stuart R. Boyd†

**Enrico Fermi Institute , University of Chicago, Chicago, IL 60637;*

†Dept. of Earth Sciences, The Open University, Milton Keynes MK7 6AA, U.K.

Nitrogen in the basal layer of the K-T boundary clay at Woodside Creek, New Zealand, has an abundance of 1100 ppm, a 20-fold enrichment over Cretaceous and Tertiary values (figure 1). The enrichment parallels that for Ir and elemental carbon (soot) (1); all decrease over the next 6 mm of the boundary clay. The C/N ratio, assuming the nitrogen to be associated with organic rather than elemental carbon, is approximately 5 for the basal layer compared to 20-30 for the remainder of the boundary clay. The correlation between N and Ir abundances appears to persist above the boundary, implying that the N is intimately associated with the primary fallout and remained with it during the secondary redeposition processes that kept the Ir abundance relatively high into the lowermost Tertiary. $\delta^{15}N$ is +2.0‰ in the basal layer, but decreases to -4.4‰ at the top of the boundary and -8.2 ‰ in the lowest Tertiary sample (figure 2), compared with -8.1‰ for the sample immediately below the boundary.

Apparently the basal layer of the boundary clay represents the accumulation of a substantial quantity of N with an isotopic composition approximately 10‰ heavier than background $\delta^{15}N$ values. If the boundary clay represents an altered impact glass from a meteorite impact then it probably denotes a time period of less than 1 year (2). Therefore, the changes in nitrogen geochemistry apparently occurred over a very short period of time. The high abundance of N and the correspondingly low C/N ratio may reflect enhanced preservation of organic material as a result of the rapid sweepout and burial of plankton by impact ejecta, with little or no bacterial degradation (1). It is conceivable that the shift in $\delta^{15}N$ may represent an influx of nitrogen from a different source deposited contemporaneously with the impact ejecta. An interesting possibility is that it may be derived from nitrate, produced from the combustion of atmospheric nitrogen as proposed by Lewis *et al.* (3). Acid rain would be one of the first effects of the impact so that any geochemical signature associated with it would be expected in the basal layer. It is unclear whether such nitrogen could be biologically assimilated or otherwise rendered insoluble in the presumably short time prior to the fallout of ejecta or before a decrease in pH killed surface water planktonic species. However, abiotic reactions of surface water plankton with HNO_2 + HNO_3 could provide a mechanism for an enrichment in N content.

References

1. Wolbach W.S. *et al.* (1988) Nature (in press).
2. Toon O.B. *et al.* (1982) GSA Spec. Publ. **190**, 187-200.
2. Lewis J.S.*et al.* (1982) GSA Spec. Publ **190**, 215-222.

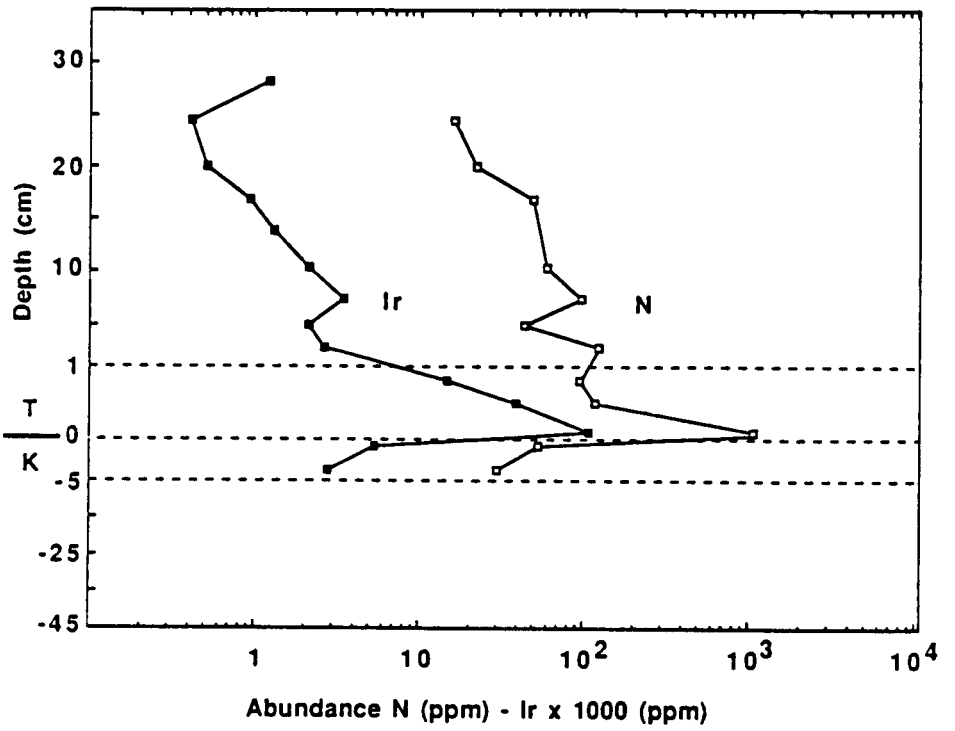

Figure 1

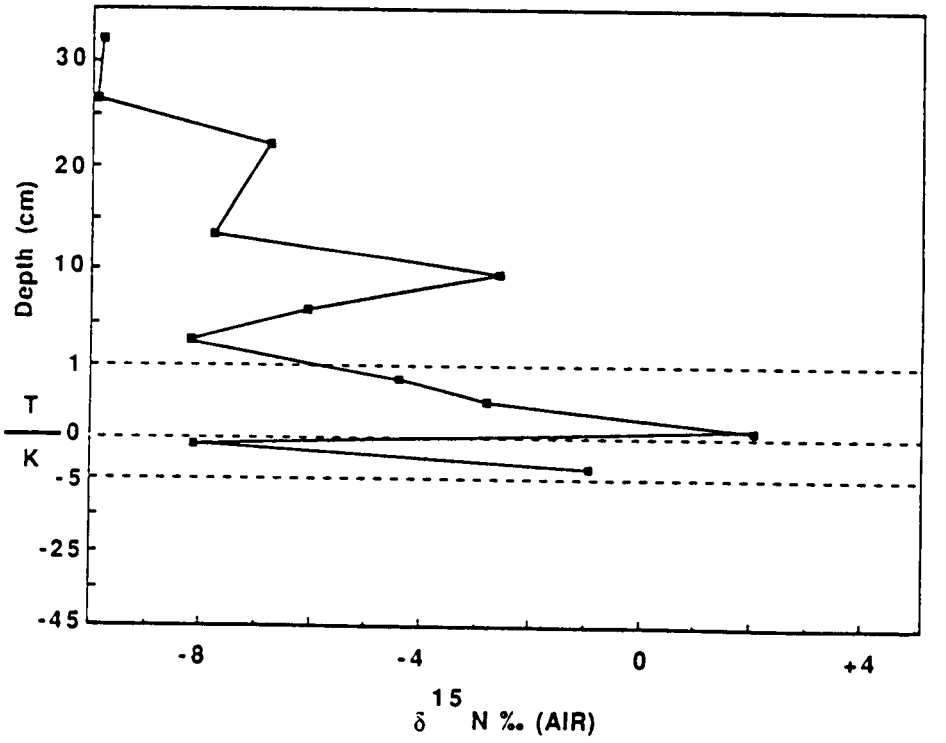

Figure 2